thereto and to each other by the bolts, 36. The clamp to the left in Fig. 12 is connected with the buckle, 26, by the pivoted bolt, 38. The bolts, 25 and 38, are threaded oppositely so that the rotation of the buckle tends to tighten or slacken the cable.

In use the cable, 35, rests centrally along the wearing plate, 14, being held in place partially by its own weight. The clamps and turnbuckle are next placed in position and the clamps bolted to the cable. This obviates any chafing of the insulating material, for all wear is borne by the plate. If it is desired to adjust the cable this may be done by turning the turnbuckle, 26, so as to pull the cable in the direction required. By the use of this turnbuckle, with the clamps tightly gripping the cable, the small portion of the cable between the clamps may be made to buckle slightly, thus transferring most of the strain from the top of the wearing plate to its ends. If the cable should break the slack cannot extend farther than the two insulators located on the opposite sides of the break.

The corrugations, *7a*, not only serve to retard the creep of moisture by breaking up the surface of the insulator, but also serve if required as rests for additional cables. If for any reason the cable, 35, should become detached from its fastening it may still rest between these corrugations.

It will be noted that the disks, 10, taper. Wires may therefore be inserted between them, as 40 and 41, Fig. 11, and wedged firmly in position. Thus a telegraph or telephone wire, or even a so-called "third" wire, may be carried without detriment to the general usefulness of the insulator.

WIRELESS TELEGRAPHY.*

SOME OF ITS PRACTICAL AND COMMERCIAL ASPECTS.

BY WILLIAM MAVER, JR.

PART I—TECHNICAL ASPECTS.

Wireless telegraphy now appears to be settling down on a practical basis. It is finding its important field to be where all those who have not been actuated by interested motives have consistently stated it would be found—namely, as a means of communication between ships at sea and between ships and the shore. How long it will hold this field undisputed depends upon the measure of success that may attend the efforts of those who are now endeavoring to perfect wireless telephony. At least half a dozen inventors are at work on this problem in this country and Europe, and it is reported that the wireless transmission of speech has been experimentally successful up to distances of several miles over land; but apparently much remains yet to be done before wireless telephony, even for short distances, becomes an accomplished fact. Should this hoped-for result be achieved, however, it is evident that for many purposes it will displace wireless telegraphy. For example, probably one of the chief reasons why wireless telegraphy is not already universally installed on all manner of sailing vessels and steamships is the necessity for employing an expert Morse operator to transmit and receive messages. Wireless telephony, even if only available for a comparatively short distance, obviously could be installed to advantage in the officer's room of every ship that floats the ocean, lake, river, or harbor, and perhaps on railway trains as well, for any purpose that might arise.

Wireless telephony is not yet here, however, while fortunately for those that go down to the sea in ships, wireless telegraphy is here, and it is already installed or is being installed on every lighthouse and on the vessels of every important navy and steamship line in the world. It is probably easily within bounds of accuracy to say that there are now over 2,000 wireless stations, including ship and shore stations, in operation in various parts of the world, and this number is being added to daily.

The distances covered by wireless telegraphy in regular operation may be set at from one mile to fifty or 100 miles. When the statement is made, as it frequently has been, that messages have been received from ocean-going vessels several days out from New York, it may be taken for granted that these messages have been received at one or other of the Atlantic coast stations within wireless signaling distance of the vessel, and by those stations repeated by overland wire telegraphy to New York. There is no doubt that messages are received under favorable conditions at distances of several hundred miles away from shore, but these are exceptional cases. No regular interchange of business is at present carried on at those distances.

While we frequently run across the statements of interested brokers in wireless-telegraph stock that transatlantic wireless telegraphy will shortly be accomplished, it is noticeable that Marconi, Fessenden and De Forest have of late been silent on this subject. Fessenden indeed has, with commendable frankness, practically admitted that the difficulties of transatlantic wireless telegraphy are at present well-nigh insurmountable. His experiments were continued for nearly one year between Massachusetts and Scotland. He found that there are at least two serious obstacles in the way of transatlantic wireless signaling. First, atmospheric absorption of the electric-wave energy of the signals. Up to distances of 1,000 miles this absorption is not very marked, but beyond this point it becomes very important. The other difficulty consists in the inability to maintain syntony, or tuning of the apparatus, at the respective transmitting and receiving stations. The difficulty, in the words of Mr. Fessenden, "is in getting the stations which are to communicate to maintain their frequencies sufficiently regularly." It was found impossible to receive messages when the frequency varied one part in 1,000,000. This, it may be noted, is equivalent to saying that if a telegraph system which depended for its successful operation upon the synchronism of wheels at the sending and receiving stations should vary one part in 1,000,000 the system would not operate. While Mr. Fessenden is hopeful that these difficulties will be overcome, the prospect for an immediate realization of this hope is not very encouraging. But fortunately, again, there is no real necessity for transatlantic wireless telegraphy, or cableless telegraphy, as some wireless experts take pleasure in terming it. The Atlantic cables are still doing business at the old stand, and there is every reason to believe that they will continue to do so for many years. Singular as it may seem to some people there is, apart from occasional injury to the cables, no method of telegraphing that is as reliable as submarine-cable telegraphy. The reasons for this are obvious. The cable, year in and year out, works undisturbed by changes in weather conditions. Lightning storms do not affect its operation, and vagrant currents from neighboring and unneighborly electric-traction circuits, or induction from high-tension alternating-current systems, can never approach within harmful distance of its sensitive apparatus. Similar immunity from these disturbing factors in overland telegraphy would, there is no doubt, be gladly welcomed by the members of this association.

Apart from the filings coherer it may be said that the most prominent type of detectors now in use are the magnetic detector employed by the Marconi interests, the carborundum detector employed by the De Forest Company and the various electrolytic detectors of the Fessenden and Shoemaker types. The magnetic detector, the carborundum detector and the electrolytic detector require a telephone receiver for the reception of signals. The magnetic detector was described in the author's paper on "Improvements in Wireless Telegraphy, read before the Indianapolis convention of this association. The carborundum detector consists of a crystal of carborundum which is clamped between two metal electrodes. Otherwise, so far as the arrangement of circuits is concerned, it simply displaces the filings coherer, but does not operate a relay. The electrolytic detector consists of a small cup containing a dilute solution of nitric acid, into which the terminal of a very fine platinum wire is placed. Another wire enters the acid from the bottom of the cup. When current from a small dry battery is passed through the solution by means of the fine wire, polarization takes place and the current ceases to flow in the circuit. Incoming electric waves appear to dissipate this polarization, causing variations in the current of the local circuit, and sounds corresponding to dots and dashes are heard in the telephone receiver.

The De Forest "audion" is also one of the more recently invented wireless detectors. This detector, briefly described, consists of an incandescent filament in a vacuum, shunted by a local circuit in which is a battery and a telephone receiver. Incoming electric oscillations appear to affect the electrical condition or equilibrium of this circuit and set up variations of current therein which are heard as dots and dashes in the telephone receiver. This receiver was fully described in the transactions of the American Institute of Electrical Engineers for 1906.

Another detector which promises to be of utility in practical wireless telegraphy is the silicon detector, the invention of G. W. Pickard. This detector is of the thermoelectric type of wireless receivers. It produces its own electromotive force. Its electrodes are pure silicon and a metallic element of low resistance. The energy of the incoming electric oscillations is converted into joulean heat (C^2R) at the element having high resistance (the silicon), which heat is converted at the contact point into a short pulse of direct current in the telephone receiver; and a long or short continuation of these pulses produces a dash or dot in the receiver. Mr. Pickard states that a fragment of silicon merely held with suitable pressure between two flat-ended brass rods gives excellent commercial results. This detector has the advantage that no battery is required in the local circuit. In sensitiveness it compares favorably with the electrolytic and magnetic detectors, according to tests made by Mr. Pickard. The carborundum detector is about one-half as sensitive as the last-named detectors.

It is interesting to note that the telephone receiver has been found to respond to a single impulse of current of very much less strength than is required to energize the most sensitive wireless detector, and were it not for the high inductance of the telephone receiver, the intermediate wireless detector would not be necessary. At the high frequencies used in wireless telegraphy, however, namely, of the order of 500,000 or 1,000,000 per second, the inductance of the telephone receiver renders it mute.

An improvement in wireless telegraphy that may lead to important results consists in the use of undamped oscillations, with which numerous experiments are now being made by Poulsen, Shoemaker, the Telefunken Company, and others.

In the ordinary "spark" gap transmitter, it is known that between each spark or train of sparks there is a rapid falling off or damping of the amplitude of oscillations; consequently the full benefits of resonance in the tuned receiving circuits are not obtainable. Poulsen's method of obtaining undamped oscillations is an amplification of the Duddell "singing arc" and consists in employing an electric arc of peculiar construction shunted with a capacity (condenser) and inductance of a wireless transmitting circuit.

In Poulsen's device the positive electrode is copper, the negative electrode is carbon. When the capacity and inductance are suitably adjusted, rapid oscillations of uniform amplitude are established in the circuit and thence are thrown upon the vertical wire. These oscillations are broken into dots and dashes in the usual way. Unfortunately, thus far the energy output by this method is low, and it remains to be ascertained whether or not the advantages of uniform amplitude by conducing to a better utilization of resonance will more than offset the disadvantage of reduced energy output.

Another improvement in the practice of wireless telegraphy consists in the employment of electric-wave meters by means of which the wave-length or the wave frequency may be measured. These wave meters are based primarily on the principle that with an exciting circuit in proximity to a secondary circuit, a maximum current will be induced in the secondary circuit when the two circuits are in resonance, which will be when they possess corresponding inductance and capacity. Knowing the capacity and inductance of the secondary circuit, the frequency and wave-length of the oscillations are deducible. (A detailed description of electric-wave meters may be found by those interested in the last edition of the author's work, "Wireless Telegraphy.") Increased familiarity of the operators with the apparatus has also naturally tended to improved results in the actual operation of the various systems. Apart from the foregoing noted features and certain improvements in the details of apparatus and the arrangement of vertical wires, there has been comparatively little advance made in the art of wireless telegraphy during the past one or two years.

A short description of some experiments conducted recently by the Telefunken Wireless Telegraph Company of Berlin, relating to the use of wireless telegraphy between railway trains in motion and fixed stations, may be of interest to the members of this association. The experiments were made on sections of railway track about 12.5 miles in length, with four stations about four miles apart within this distance. The wireless outfit of each fixed and moving station consisted of a filings coherer receiver and an induction coil transmitter, together with the other apparatus usually employed therewith. A coach containing the wireless outfit was equipped with a rectangular wire suspended by posts about one foot high at each corner of the roof of the coach. The wire was attached to porcelain insulators on the top of these posts. A single wire was led from this wire to the apparatus within the coach. A ground was ob-

* A paper read at the convention of the Association of Railway Telegraph Superintendents.

tained through the iron trucks of the coach. The fixed station was between the telegraph poles. The aerial wire was erected horizontally between the poles and paralleled the regular telegraph wires for a distance of 195 feet, about one foot therefrom, and was carefully insulated from those wires. A wire connected this aerial wire to the apparatus in the fixed station. The ground was made by a wire connection to the nearby rails. Current for the induction coil was supplied by eight portable storage cells giving sixteen volts and having an output of about five amperes with a spark-gap of 0.12 inch. The maximum distance of the train from the tracks was sixty-five feet.

By this arrangement reliable signals were sent and received at a distance of 7.5 miles.

As several of the members of this association have had experience with other methods of telegraphing to and from moving trains, they can probably enlighten the association as to the necessity of improvements over those methods, and also as to the utility of such systems in general.

PART II—COMMERCIAL ASPECTS.

The opinion of the writer has been frequently asked as to the merits of the great claims that are being made relative to the dividend-earning capacity of wireless telegraphy by the brokers who appear to have assumed control of the stock-selling end of one or more of the wireless companies. A few remarks bearing on these claims may, therefore, not be inappropriate at this time.

Let us first discuss the wireless telegraph earnings on the basis of the exchange of messages between ship and shore stations. According to the published reports of one of the wireless companies which has its system installed on seventy-eight steamships plying between Europe and the United States, the gross earnings for the year 1906 were approximately $55,170 for messages exchanged between ship and shore stations. This figures out to approximately 25,823 messages for the year, which is equal to a total of seventy messages per day, or less than one message per day per ship. How much, if any, of this revenue goes to the foreign wireless telegraph company that presumably owns the wireless apparatus on the ships is not stated. Presumably also certain royalties may have to be paid by the ship owners for the use of the apparatus, and there may also be additional revenue for "news" service received on shipboard. But granting this, it is difficult to figure out much net revenue after the salaries of officers and operators have been paid.

This is perhaps the best showing that can be made for wireless telegraph companies doing a general commercial business in this country, or with the ships that sail United States waters. When it is stated that hundreds of steamships own their own wireless apparatus outright, and do considerable business with government wireless shore stations without charge, the difficulty of seeing a bright prospect for the earning of dividends on capitalizations amounting to six, eight or ten millions of dollars by a legitimate exchange of wireless messages between ship and shore stations is largely increased.

One of the large German wireless telegraph companies has confined its business almost exclusively to the manufacture and sale of its apparatus outright to customers, and it is understood they have made fair profits. Several companies in this country are doing likewise. Obviously, therefore, there is no monopoly of this art on the part of any one company, although such a claimed monopoly is the chief stock-in-trade of certain of the stockbrokers referred to. An analysis of the published claims put forth by certain stockbrokers to induce the purchase of stock in a wireless telegraph company shows some glaring misstatements, seemingly at least calculated to mislead prospective customers as to the constructional and operating costs, etc., of the system. Another method to induce purchase of stock consists or did consist of sending broadcast by mail circular letters offering stock of a wireless telegraph company at $110 per share, guaranteeing five per cent per annum on the stock for five years. This appears a fair enough proposition until it is known that the stock was at the time offered on the New York curb at $30 to $36 per share.

This offer was accompanied by the most glowing accounts, without regard to the many difficulties in the way, of the prospective earnings of the company, by means of transatlantic wireless telegraphy and by overland wireless telegraphy as well. It is but fair to say that the managers of at least one of the companies whose stock is being used in this way have disclaimed any responsibility in the matter. Unfortunately, it is to be feared that the brokers were only too successful in unloading stock to unsophisticated purchasers on this basis.

The author of this paper has frequently taken occasion to express his admiration for wireless telegraphy as an art and to point out its extreme importance in the field for which it is so well adapted. It should be, however, he believes, as much the duty of one more or less familiar with the facts to point out, when opportunity offers, the limitations of a system, and the erroneous and seemingly misleading claims made in its behalf, as to laud its merits and advantages. This constitutes the reason for the writing of this paper.

FOOD VALUE OF CORN AND CORN PRODUCTS.

A DIETETIC ACCOUNT OF AN IMPORTANT CEREAL.

Although a native of the new world and first extensively cultivated here, Indian corn or maize is now grown very generally wherever the climate permits. In the United States corn is by far the most important cereal, and is grown in every State, though the southeastern and middle western sections are the great corn regions. The greater part of the corn crop is used for feeding live stock and poultry, or for starch making or other manufacturing purposes. Nevertheless, corn has always been and still is a favorite and very important source of human food in America, and especially in the South Atlantic States, where it ranks with wheat as a breadstuff.

The germ of corn makes up an unusually large percentage of the kernel as compared with most grains, and as the germ is very rich in fat the grain as a whole is characterized by an unusually large proportion of this constituent. The proportion of protein is also fairly high. Carbohydrates, particularly starch, make up the greater part of the nutritive material of corn, as of other cereals. Until about fifty years ago corn was simply ground and then bolted or sifted at the mill or at home in making meal for cookery, but now it is usually kiln-dried and deprived of the outer skin and germ before grinding. The modern granulated corn meal is bolted to free it from offal products and is finer and keeps better than the old-fashioned sort, though it does not differ from it very materially in composition except that it contains a little less fat and crude fiber. The removal of the corn oil modifies the flavor, though it undoubtedly improves the keeping qualities. In general, corn meal contains a little more fat and starch and a little less protein than wheat flour, but after all it resembles this staple foodstuff quite closely in chemical composition.

The changes brought about in corn by the heat of cooking are much the same as those observed in other cereal grains. Thus, the cell walls made up of indigestible crude fiber are softened and broken down and so the starch inside may be more readily reached by the digestive juices. Heat, with or without the presence of water, changes some of the insoluble starch into forms which are easily dissolved, a condition favorable for digestion. Cooking has further advantages in that it improves the flavor of corn and thoroughly sterilizes it, a matter which may be very important under some conditions.

Corn protein does not contain the elastic, tenacious gluten which is characteristic of wheat protein and so corn meal does not give a light porous loaf with yeast. For this reason corn meal alone is seldom used for raised bread, but is usually baked in thin cakes which are granular rather than porous, although such leavening material as eggs, sour milk with soda, etc., may be used in making the batter. When corn meal is mixed with wheat flour or rye flour the dough may be raised with yeast. Such bread, of which "rye and Indian" bread is a typical example, is most palatable when slowly cooked in rather large loaves. Corn meal is often used for making mush or porridge. Under the name "hasty pudding," this dish used to be a favorite in New England and is still frequently served as a supper dish.

Samp and hominy, which are much less finely ground than corn meal, are cooked like other grits and are commonly used as a breakfast cereal or as a vegetable to accompany meat. Hominy is now frequently made without the skin and germ. Like other similar cereal goods hominy and samp require long-continued and thorough cooking, especially when coarse.

Hulled corn is an old-fashioned dish in which the kernels, instead of being ground or degerminated, are steeped in lye until the hulls are loosened, soaked in clear water until free from alkali, and then boiled until soft and tender.

There are various proprietary breakfast foods made from corn. In most of these the grain has been cooked until tender and then rolled or flaked and sometimes parched with or without the addition of malt or other flavoring material.

Small hard varieties of corn when shaken over a hot fire pop or burst to a white, light mass, owing to the sudden expansion to steam of moisture in the cells making up the interior of the grain. Popped corn is sometimes used at table, but is usually eaten out of hand. The total amount consumed is fairly large. Varieties of corn which will not pop are sometimes parched and eaten and are also used as a coffee substitute.

Cornstarch has long been an important foodstuff commonly used for making puddings and desserts and for invalid cookery. Glucose made from cornstarch is a very common commercial product. The use of corn oil as a culinary fat is comparatively recent but seems promising.

Corn meal and other corn products are used in making an endless variety of batter breads, cakes, and other dishes for which recipes may be found in books devoted to cookery.

Unripe or green corn is frequently used as a vegetable, particularly in America. Like all green vegetables it is succulent and contains a small amount of nutritive material in proportion to its bulk, being esteemed for its pleasing flavor and the variety which it gives to the diet rather than for its direct food value. Corn canned alone or mixed with beans or tomatoes is a common commercial product, reasonable in price, and a useful addition to the list of vegetables, particularly in the winter diet.

Careful experiments made to test the digestibility of corn indicate that the carbohydrates are almost completely utilized by the body no matter how the grain is cooked. The method of preparation, however, apparently makes considerable difference in the digestibility of the protein. Thin, porous corn bread, such as johnnycake, and even the thick loaves of Boston brown bread, made of equal parts of corn, rye, and wheat, furnish as large a proportion of digestible protein as white wheat bread raised with yeast. On the other hand, the protein of hoecake (corn meal mixed with water and baked in thin sheets) has been found to be slightly less digestible than that of wheat bread, while the protein of hasty pudding and boiled hominy is only about 73 per cent digestible as compared with 83 to 86 per cent in the above-mentioned types of corn bread.

The corn breakfast foods and other corn products have much the same digestibility as corn meal when cooked in similar ways. The variations which have been noted with the different corn breads and other corn dishes are of the same character as those observed with similar foods made from wheat flour of different sorts.

Corn, though a wholesome and very useful foodstuff which may be cooked in many ways, is not likely to replace wheat as a leading breadstuff where the latter can be obtained, as wheat bread is commonly considered to be more appetizing for everyday use and has an advantage in that it keeps for a longer time in good condition after baking. Corn breads, however, give a pleasant variety to the diet, and being more easily and quickly made than wheat bread are especially useful when hot bread is wanted and time is limited. Corn breads and corn cakes are so easily made that they are favorites in camps and wherever cooking appliances are few and simple.

Where conditions are especially favorable to corn cultivation, as in the mountain districts of the southeastern United States, some parts of Italy, and the Balkan regions of Europe, corn is often the staple cereal food and not infrequently the principal article of diet for the poor. In times of distress people have lived on this grain alone for considerable periods, but, like other grains, it contains too little protein in proportion to its fat and carbohydrates to supply the body with nutritive material in the proper proportion, and it should be combined with materials rich in protein, such as lean meat, milk, cheese, dry beans, etc. When thus combined it is a healthy, nutritious, and inexpensive food and has been proved by common experience to be wholesome, palatable, and a welcome addition to the diet.

Considering all of its uses, corn is one of the most important cereal foods from the standpoint of palatability, nutritive value, and digestibility. It may be prepared for the table in a great variety of ways, and in some form or other is deservedly used in the majority of American homes.—From a Bulletin by Dr. Charles D. Woods issued by the U. S. Dept. of Agriculture.

The "Mars" battleship has established a record for the port in coaling at Portsmouth. Lying alongside the depot she shipped 1,240 tons in 4 hours 5 minutes.